2035 Implementation Project – Phase 1

Executive summary

The Engineering Futures Initiative is a significant disruption to how change in engineering education has been led. It represents a coherent, visible, national approach that brings together all stakeholders into a single entity, with dedicated staff to resource the work.

The Initiative will lead, drive, and host the activities necessary for progressive implementation of the Engineering Futures 2035 recommendations at a national level. The Initiative will, in the first 12 months, implement a **national student projects** program in partnership with industry, establish associated **national benchmarking approaches**, and collate **exemplars, practice guides and case studies** to guide curriculum innovation. The focus of the Initiative in Phase 1 will be on human/social-oriented curriculum and pedagogy.

The Initiative will be funded in the first 12 months from ACED member contributions to a total of $200,000 as agreed at the October 2022 ACED meeting. Subsequent years will be co-funded by industry and government sources as the Initiative is scaled up.

The Initiative and its activities will deliver immediate benefits for key stakeholders.

For Engineering Faculties:

- Support for staff to implement industry-based projects in teaching, with lower start-up costs, mentoring, and networking
- Benchmarking data to support education design, market differentiation, and achievement of Engineering 2035 goals
- Access to exemplars and practice guides to accelerate successful uptake of new approaches

For Industry:

- A mechanism for connecting with engineering educators to establish student projects across multiple institutions
- A streamlined process for connecting and engaging with engineering students through authentic industry projects
- Potential solutions to, and new directions for, engineering problems

For Government:

- A platform to energise university-industry engagement in the education sphere

Mission

The primary aim of Phase 1 of the Implementation Project is to establish a national-level leadership, support, and monitoring mechanism to drive the changes recommended in the Crosthwaite report, *Engineering Futures 2035, Engineering Programs, Priorities and Pedagogies*.

The approach outlined here is guided by four key principles:

1. Enable systemic change to support human/social focus in engineering
2. Achieve 'quick wins' that start the work now
3. Build sector capacity towards the 2035 recommendations
4. Work cooperatively, and progressively, using a approach that is attractive to partners outside academia.

Plan

The 2035 report emphasises a need for urgent change:

> *We could just let education drift on and there will be some changes that will meet the needs of the future, but it probably will be too slow for the challenges that are heading our way. Crosthwaite, 2019.*

Consequently, a national mechanism will drive change on four fronts, simultaneously with an initial focus on human/social-oriented curriculum and pedagogy:

1. An agent for change – the **Engineering Futures Initiative (EFI)**, which will have oversight of, and drive Engineer 2035 objectives over time, as well as promoting exemplar educational models and practices and sourcing ongoing funding.
2. Directly supporting the change – making **real world, industry sponsored, and socio-technically focused projects** available to all students in the first 12 months.
3. Monitoring the change – a national **benchmarking methodology** to measure the change in educational models focused on human/social curriculum, and graduate professional practice skills over time.
4. Informing the change – compiling **exemplars, practice guides and case studies** for education innovation and industry engagement.

Success criteria

In the first 12 months, the success of the Engineering Futures Initiative will be demonstrated by:

1. Up to five industry-partnered projects available for implementation in existing education programs, with at least 3 piloted in the first 12 months across multiple institutions
2. Establishment of a website publicising national projects, showcasing stakeholders, and hosting a range of supporting materials
3. Collation of a range of resources specific to human/social engineering curriculum hosted on the EFI website (videos, activities, case studies, practice guides, etc.)

4. ACED endorsement of a draft framework to capture, visualise and monitor ways engineering schools implement Engineering 2035 recommendations
5. Commitment for further funding of the Initiative from Industry and/or government partners matching or exceeding the ACED seed funding of $200,000

Implementation Framework

The Engineering Futures Initiative is a coordination and leadership mechanism to implement all of the Engineering 2035 project recommendations over time. The framework below depicts the initial focus on human/social contexts in curriculum and practice. The programs of work (national industry projects, benchmarking and monitoring and exemplars, practice guides and case studies) will grow in subsequent phases to address digital tools, real world complexity, and inclusive and diverse workforces, and other components of the 2035 recommendations. Integrated attention on academic development and industry engagement will remain constant.

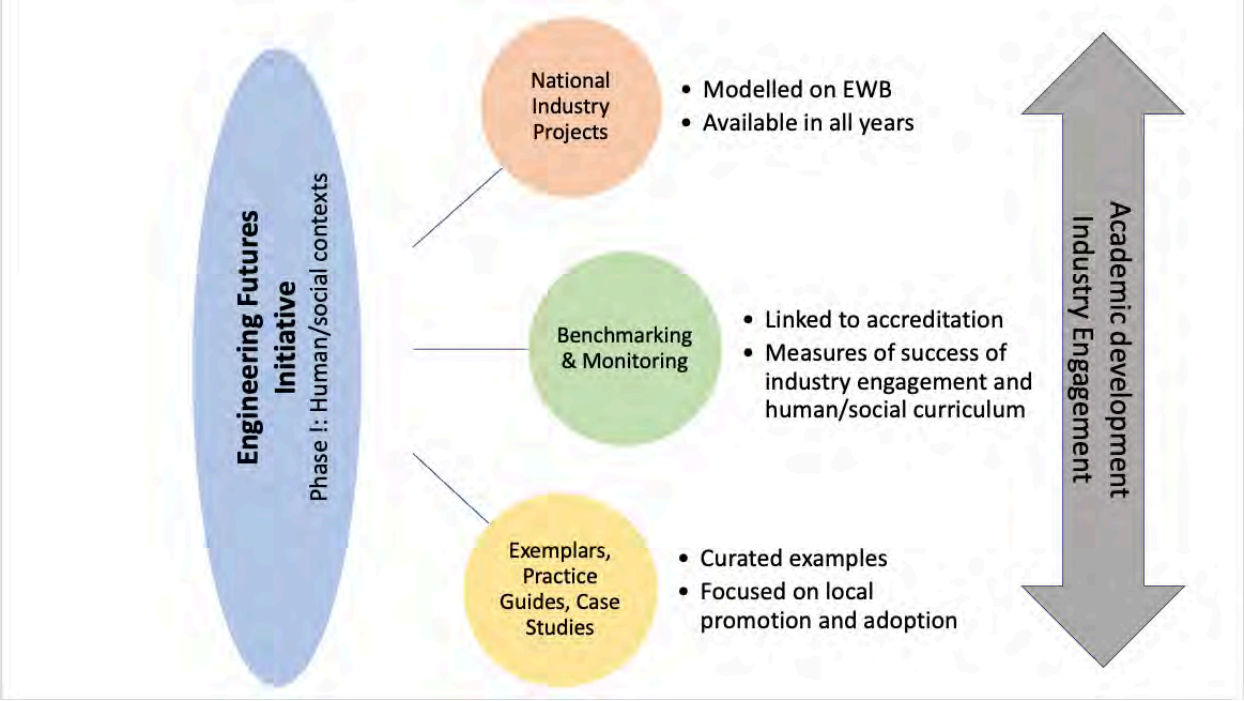

Figure 1 Initiative general structure and activities

The Engineering Futures Initiative

This semi-permanent structure provides the resourcing to lead and host the development of activities for the 2035 Implementation project. The Initiative will coordinate national-level activities and deliver ongoing advocacy and monitoring of project/activity outcomes. Further activities would be developed over time in conjunction with ACED, Engineers Australia, employers, graduates, and students.

As an independent forum, the Initiative will balance the interests of academia, industry, and professional bodies. The initiative should be seen as a cooperative space to drive change, in a manner similar to SAGE (Science in Australia Gender Equity) or Cooperative Research Centres. The Initiative would focus solely on progressing the Engineer 2035 agenda.

Initial program of work

In its first 12 months, the Engineering Futures Initiative would be responsible for:

1. **Establishing itself** under the direction of ACED and agreed stakeholders: staffing, terms of reference, web presence, and governance structure.
2. Developing a **five-year plan** for the further stages of the implementation project.
3. Delivering **National Industry Projects** available to all ACED member institutions.
4. Compiling (or contracting as necessary) a range of **exemplars and practice guides** for innovative engineering curriculum and models of industry engagement.
5. Developing a **Benchmarking and Monitoring** methodology
6. **Advocacy** within ACED and other stakeholder groups.

National Industry Projects

To support immediate change, we have identified the need to facilitate connections between industry and academia, which support student learning experiences directly. Project-based learning (PjBL) is commonly used for learning experiences, which have real world focus and rich social, economic, and environmental contextual relevance, in addition to technical challenges. However, these projects require establishment and leveraging of industry connections and can take time to develop into effective educational experiences. Opportunities can be further hindered by misalignment between availability of projects and availability of suitable educational contexts (e.g., units of study).

An **Industry-led Engineering Student Projects** Program will curate suitable projects with industry partners and make them available to universities for a range of applications and year levels. The program will offer educators ready-made project briefs, industry partnerships, and access to a network of peers implementing similar project-based learning approaches to support academics' professional development. Projects may be offered under various themes, such as Industry 4.0, energy transition, infrastructure renewal, etc.

The nationally accessible project approach has proven impact in transforming curriculum. The Engineers Without Borders challenge, for instance, has effectively driven the expansion of Humanitarian Engineering across the sector, supported the emergence of communities of practice, and prompted many institutions to implement their own expanded humanitarian engineering offerings. The National Industry Projects would broaden this methodology.

The approach offers:

1. Opportunities for cross-institutional collaboration on established projects.
2. Opportunities for students to participate across multiple years of the curriculum.
3. A national showcase of student capability that is visible to industry.

4. A platform for fostering industry-academic education partnerships and innovative approaches to connecting students with professional practitioners.

Benchmarking and Monitoring

In the *Engineering Change* report, ACED is responsible for a Call to Action as follows:

> *Develop an on-going evaluation framework which will track progress of the implementation of this report to ensure the required changes are delivered*

The development of a benchmarking and monitoring framework will enable the current state to be assessed and future progress to be tracked. Institutions will have access to their own data as well as aggregated data from the sector, enabling Deans and Associate Deans to quickly assess what needs to be done in their own context. The benchmarking approach will have secondary benefits of enabling institutions to meet accreditation benchmarking requirements to a significant degree, and more clearly establishing differentiation from competing engineering programs.

Much of the data required is already collected for accreditation purposes (e.g., approaches to industry engagement, mapping learning opportunities to relevant Stage 1 competencies), streamlining the effort required to establish the benchmarking data. There will be an initial focus on benchmarking human/social centred curriculum activities (e.g., ethics, community relations, stakeholder engagement, collaboration, empathy), broadening later to other areas emphasised in the Engineering 2035 recommendations including benchmarking against Industry standards and expectations.

Establishment of quantitative benchmarks has driven widespread change in the sector in recent years, most notably in the research sphere. Current education indicators such as QILT (Quality Indicators in Learning and Teaching) are helpful and widely used, but lack detail needed to inform focused and efficient change in the sector. The Engineering Futures 2035 benchmarking methodology would rectify this.

Exemplars, practice guides and case studies

Provision of curated exemplars, practice guides and case studies is an important supporting component of the Initiative. Several precedents exist for this approach and have provided newcomers with advanced ‘starting points’, shortcutting the learning and development time usually required of staff. Work on this component would be led by the Engineering Futures Initiative staff, initially compiling existing materials and resources, then commissioning new resources as needs are identified. Promotion of resources will be a critical component of the work – while it is known that exemplars, practice guides and case studies are helpful, it is also known that simply providing access to these resources this approach does not *drive*

change. Further, the ongoing maintenance/updating of these resources by the EFI is also critical to their ongoing relevance and utility.

Leadership and Governance

Oversight of the EFI and its activities will be led by ACED, in partnership with Engineers Australia, AAEE, and the ADTLN. The proposed Directorship will be comprised of:

- ACED president or Council nominee
- AAEE president
- ADTLN Chair
- EA President or nominee
- Industry representative
- Student representative
- 2x co-opted positions

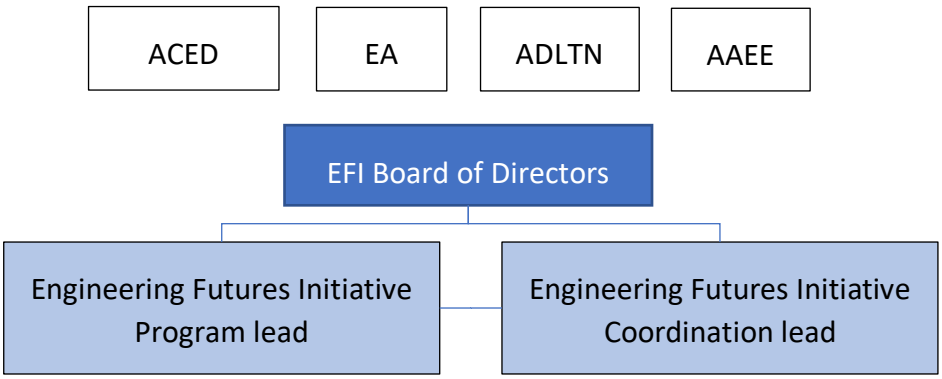

Figure 2 EFI Governance structure

Engineering Futures Initiative Program lead – Key responsibilities:

- Educational design and development
- Planning of EFI activities and foci
- Design and development of EFI programs of work (industry projects, benchmarking methodology, exemplars, etc.)
- Development of EFI procedures and policies
- Stakeholder engagement, involvement and negotiation (e.g., educators, industry, EA colleges, etc.)
- Design and leadership of industry engagement activities
- Delivery of academic development opportunities

Engineering Futures Initiative Coordination lead – Key responsibilities:

- Scheduling of activities
- Oversight of finances
- Website and communications
- Administration and coordination of industry engagement activities
- Communications across stakeholder groups and coordinating stakeholder contributions
- Implementation of programs of work

Engineering Futures Initiative Board of Directors – Key responsibilities

- Seek further funding from ACED, Industry and Government
- Advocacy and promotion of EFI activities
- Supervision and recruitment of EFI staff
- Oversight of EFI procedures and policies

Initiation timeline (Nov 2022-Feb 2024)

Establishment, Nov 2022 – March 2023

In establishing the Engineering Futures initiative, ACED will:

1. Secure funding for the EFI from ACED members
2. Assemble the board of directors group with key industry supporters to guide the project
3. Finalise mechanisms to manage the overall activity (e.g. board terms of reference, staff employment arrangements)

The EFI Board of Directors will then:

1. Finalise position descriptions for the EFI Program lead and coordination lead roles
2. Facilitate recruitment of EFI Program lead and coordination lead
3. Draft policies and procedures governing the operation of the EFI

Initial operations, April 2023 – Jun 2023 (commencement of funding period)

EFI staff will:

1. Establish industry project brief templates and initial project offerings for 2nd half of 2023
2. Set up website
3. Search and compile existing resources – curriculum models, assessment designs, case studies, etc.

EFI board of directors will:

1. Provide direction on EFI activities
2. Oversee EFI staff activities described above
3. Assist in making connections with educators and industry

ACED will:

1. Commence advocacy to government and industry for future funding
2. Monitor establishment of the Board of Directors, EFI staffing, and initial industry connections.

Pilot operations, July 2023 – Feb 2024

Projects, website, supporting resources, and industry/educator connections will have been established; projects will be underway. EFI coordination team will then:

1. Oversee and support implementation of industry projects in participating institutions
2. Compile literature survey on benchmarking methodologies and develop draft framework
3. Support dissemination of project progress outcomes
4. Contribute to the advocacy role in partnership with EFI Board and ACED to secure further funding for the initiative from government and industry

5. Undertake planning for the subsequent phases of the initiative, including financial planning, in consultation with the Board of Directors

Operations beyond February 2024 will be subject to the planning undertaken by the EFI coordinators, board, and key stakeholders. It is proposed that work beyond this point will involve expansion of focus from the human/social context of engineering to enacting other key facets of the Engineer 2035 reports, including:

- Inclusive and diverse engineering workforce
- Digitalisation of the profession
- Complex problem solving
- The future engineering education workforce profile

Background to this proposal

The primary recommendations from the Engineering Futures 2035 Review of Engineering Education (2018-2021) centre on educating our student engineers with a greater emphasis on professional practice through:

a) More student learning taking place within authentic engineering contexts, allowing for greater exposure to real-world, complex and meaningful socio-technical engineering problems,

b) an increased emphasis on delivering the human/social knowledge and skills needed for graduates to successfully embrace these socio-technical engineering problems; and,

c) an increase in the number of engineering academics with professional practice backgrounds and connections.

A final report “Engineering Change - The future of engineering education in Australia” was issued by the Australian Council of Engineering Deans (ACED) in mid-2021 with Calls to Action allocated to Industry, Government, Schools of Engineering, and Engineers Australia.

The ADTL Network (ADTLN) was charged with developing an implementation proposal and advise ACED on the best course of action towards achieving the aims of the 2035 vision. A project to support the ADTLN in developing an Implementation Plan was proposed by Associate Professor Carl Reidsema and Professor Roger Hadgraft and received funding by ACED in December 2021. The outcome of this project was to develop Phase 1 of the Implementation Plan.

What consultation and collaboration have taken place?

The proposed ideas have been developed by a team of Associate Deans (Teaching and Learning) and engineering education leaders, collaborations with Engineers Australia and industry guests, as well as the core implementation project team. The ideas have been presented for feedback from these stakeholders as well as the ACED executive and Full ACED meeting.